

REMARKS

Claims 1-4, 8-14, 18-20, 22-31 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Umberger et al. (U.S. Patent 6,957,433), in view of Hinshaw et al. (U.S. 2004/012842), and in further view of Bruning III (U.S. 2002/0035667). The rejection is respectfully traversed.

As stated in the last reply, Applicant's claimed approach exposes different classes of storage to clients of the system (i.e., as reflected in the LBN), from the same storage device. The individual classes are optimized by actually determining the level of performance of storage locations, and mapping and aggregating locations having an identical level of performance to a section of the LBN (i.e., a class of storage). The combination (and its references individually) do not render obvious the subject matter of applicant's claim as a whole.

Bruning III. Applicant wishes to first address the new reference, Bruning III. The Examiner acknowledges that The Umberger-Hinshaw combination does not teach or suggest exposing to a client differentiated classes of storage (i.e., by mapping and aggregating regions to the sections of the logical block name space). Umberger, for example, discloses employing different classes of RAID but the classes are not exposed to the client. The different classes are used completely internally for providing a hierarchical storage system (Umberger 12:25-62; 13:20-14:48). The migrations of data from one level to another are transparent to system clients (Umberger 14:33-38).

The Examiner cites Bruning III, but applicant's respectfully submit Bruning III discloses no such feature. In Bruning III, a single class of service is provided to the client. Local front end controller 22 (FIG. 2) presents a mirror-striped set of disk arrays as a very large volume 10. Very large volume 10 is a "virtual volume", intended to be adequate for "single volume architecture programs" (see Bruning III ¶¶ 7 and 9; see also ¶ 20). Differentiated classes of storage are not provided to the requesting devices.

Furthermore, if the Examiner's interpretation of Bruning III were used, applicant respectfully submits that one skilled would not be motivated to combine Bruning III with Umberger. One skilled would not be motivated to completely redesign Umberger to expose its RAID levels as differentiated classes of storage. The whole point of Umberger's invention is to

provide a transparent migration mechanism for optimizing performance. To expose the RAID levels would be contrary to that purpose.

Umberger and Hinshaw. Applicant wishes to comment further on this part of the combination as applicant believes the Examiner may have misunderstood applicant's earlier remarks. Umberger discloses a system in which different workloads are migrated between different levels of RAID to attempt to optimize performance (2:6-18; 13:20-14:48). As an initial matter, the Examiner states on page 3 "Umberger further discloses a performance process for determining a level of performance for the plurality of storage locations and partitioning the plurality of storage locations into a plurality of regions as determined by their different levels of performance", citing 8:62-67. But this section of Umberger simply says different logical storage units are "generally being associated" with different "workloads". The term "workload" is defined in Umberger as not some determined level of performance, but rather simply a particular set of sequential tasks:

Herein, the term "workload" generally refers to a time ordered sequence of work requests presented for executed to a computer system or data processing system, (5:40-42).

Umberger's system monitors utilization of a given storage system (e.g., RAID level), and migrates storage operations from one system to another (e.g., from one RAID level to another) to improve performance. But there is no disclosure in Umberger that aggregated locations of a storage device are assigned a given RAID level based on a determined performance of the locations of the device.¹ Applicant believes the Examiner is actually using Hinshaw to attempt to show this feature, and has provided the foregoing comments to clarify the record.

Turning to Hinshaw, the Examiner expresses the view that Hinshaw "discloses a performance method," citing paragraph 4. Applicants have read paragraph 4 and the rest of

¹ Applicants also respectfully request clarification of the first full paragraph of p. 4 of the Office action. The Examiner expresses the view the Umberger maps partitioned regions and aggregates locations to the LBN space, citing 11:40-43 and 8:67-9:3. Applicants do not understand this part of the rejection. Column 11 lines 40-43 does not describe "regions" or "tracking". It merely says that RAID-5 operates on blocks of a chosen fixed size across each of the drives, and that the set of blocks across the drives with a given block number is referred to as a "stripe". As for column 8 line 67 to column 9 line 3, that merely says that a network of storage systems normally carries more than one "workload" (as defined) -- naturally enough, because the normal usage of a SAN is that it provides a shared service for a number of clients, and the offered loads from those several clients will not in general follow the same pattern.

Hinshaw and do not see how the Examiner finds a process that determines a level of performance of storage locations of the storage device (for partitioning the device). To the contrary, Hinshaw's system does not use such a process, but rather simply "takes advantage of ... physical properties" of the disk to unintelligently assign, regardless of actual performance, the data and mirror segments (§ 48). Applicant's acknowledge that § 48 states that in other embodiments slower sectors are located on outer tracks, but Hinshaw says nothing about how that is "determined" by the system. The only reading the Examiner may make that does not read something into Hinshaw is that in this alternative embodiment the "physical properties" of the device are again "take[n] advantage of." That is, the storage manager 404 is programmed to simply, and without making any determinations of actual performance, assign tracks to the data and mirror segments. There is no disclosure of storage manager 404 (or system manager 300) actually measuring performance to do so.

Furthermore, applicants prior remarks concerning Hinshaw were not intended to focus the Examiner on the size of Hinshaw's tracks, but rather on another more fundamental point – Hinshaw's mirror is always provided on the *slower* section of the device (cf. §§ 4-7 and 48). The Examiner's motivation for combining Umberger with Hinshaw is to "increase the speed and improve the throughput of the *overall* system." (Office action p. 4)(emphasis added). While Hinshaw states it "may" improve the "general speed" of *its* system with its assumptions about mirror usage (§ 4), one skilled would not be motivated to combine Hinshaw with Umberger because *it is simply not the case when Hinshaw's approach is applied to Umberger*. This was applicant's point in the last response. Applicant asks the Examiner how it is that the Examiner contends one skilled would actually think putting Hinshaw into Umberger's system would improve the *overall* performance of Umberger? Applicant is not arguing some benefit of applicant's own inventive approach, but rather asking the Examiner to apply the Examiner's own motivation for the combination as expressed in the Office action.

If one is to believe that Hinshaw increases the "general speed" of its system at all, then one must conclude that the increase is due to the fact that the mirror volume is not used for read accesses. The whole point of Hinshaw is to move the mirror to the slower tracks and put the main volume on the faster tracks. Umberger attempts to increase overall performance by prioritizing workloads and performing data migrations specifically to take advantage of the

different I/O characteristics of different RAID levels (13:20-14:48). One skilled in the art would understand that a mirror volume is useful for enhancing the *overall* performance of the system in Umberger because using a mirror volume to service read requests would increase the performance of given RAID levels when main volumes are too busy. But by degrading the mirror to a lower level of service as Hinshaw does, it removes the mirror from being an option for servicing requests. Hinshaw's approach would actually decrease the *overall* performance of the Umberger system, which is contrary to Umberger's stated goal of optimizing overall system performance. One skilled in the art simply would not make this combination and, indeed, would be motivated by Umberger's goal of enhancing overall performance *not* to make such a combination.

In view of the foregoing, applicant respectfully submits that a *prima facie* case of obviousness has not been made for the independent claims. Furthermore, if an independent claim is nonobvious under 35 U.S.C. § 103, then any claim depending therefrom is nonobvious. MPEP § 2143.03 (citing *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)).² Applicant believes the pending application is in condition for allowance. Reconsideration and allowance are respectfully requested.

Finally, Applicant would like to bring to Examiner's attention the apparently inadvertent omission of Examiner's initials for References A7, A8, and A9 in Applicant's Supplemental IDS submitted June 16, 2006 and returned by the Examiner with the current Office Action. Applicant respectfully requests that Examiner initial these References to reflect they were in fact considered.

² Applicant reserves the right to submit remarks concerning patentability of dependent claims should prosecution continue.

Application No. 10/761,884
Response dated November 15, 2007
Reply to Office Action of May 22, 2007

Docket No.: EQLC-P01-005

Applicant believes no fee is due with this response other than as reflected on the attached Petition for Extension of Time. However, if a fee is due, please charge our Deposit Account No. 18-1945, under Order No. EQLC-P01-005 from which the undersigned is authorized to draw.

Dated: November 15, 2007

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